Structure of a burrow of the fawn hopping-mouse *Notomys cervinus* (Rodentia: Muridae).

At approximately 0030 hrs on 4 May 2009, an adult hopping-mouse, subsequently identified as *Notomys cervinus*, was chased over a straight line distance of 100 m (although the actual path followed was zigzagged) until it disappeared into a vertical burrow (23° 46′ 08.9″S, 141° 01′13.6″E, GDA94) on a treeless, mostly grassless, claypan between Lake Constance and Hunters Gorge, Diamantina National Park, south-western Queensland. The 3 cm-diameter hole into which it retreated was flush with the claypan and not associated with any spoil from the burrow, however, another similar-sized hole 150 cm away had an obvious plume of granulated spoil (silt) flaring north-west from the hole but not surrounding the hole to form a conical depression.

Before beginning the excavation (under torch light) at the spoil-associated hole, a butterfly net was spread over the second hole 150 cm away. Dry silt was then shovelled from the inner side of the vertical exit shaft (i.e. the area between the two holes) until, at a depth of 43 cm, the burrow took a right-angle bend to lead horizontally in an arc toward the other exit. After 20 cm the burrow swung out to take on a semi-elliptical orientation. As successive biscuits of silt were shovelled off while following the 3 cm wide burrow, a hopping-mouse (adult female) fled the other exit and was trapped in, and immediately extracted from, the butterfly net. At approx. 90 cm along the burrow, four nestling mice were found in a chamber that expanded to 12 cm diameter. The young, whose eyes were unopened, were probably about 14 days old (see Watts 1983). They were found on a scant mattress of thin, chewed grass stems, the only vegetable matter to be found in the burrow complex. The chamber was palpably warm and humid.

Two burrows led from the nesting chamber, a 13 cm blind tunnel that was a perpendicular offshoot to the main burrow ellipse and another that constituted the natural extension of the main burrow. This led to the second vertical exit/entrance tunnel approximately 40 cm further on. The second vertical pipe (the one into which the chased mouse retreated from the clay pan) was 37 cm long and 3 cm in diameter. From the base of this pipe, the burrow continued on, but swung around to form the other arc of an ellipse that would eventually reconnected it with the entrance where the excavation began (Figs 1-3).

During excavation of the second half of the burrow ellipse, another hopping-mouse (adult male) erupted from a tunnel and began leaping around the open depression of the excavation. This individual was eventually hand-captured when it jumped up the inside of one of our shirts. Using a small portable plastic mouse cage furnished with a few calico collection bags and with the addition of the original nesting vegetation, the two adult mice were reintroduced to the four young, which on capture had been provided with a hot water bottle. Within minutes, the female was suckling the young.

Mid-way along the returning sweep of the burrow ellipse were two more blind tunnels: one, a short (14 cm) horizontal drive into the centre of the ellipse, and the other, a much longer (at 54 cm) upward-inclined, tangential spur, that began as a wide, smooth-walled gallery for approximately

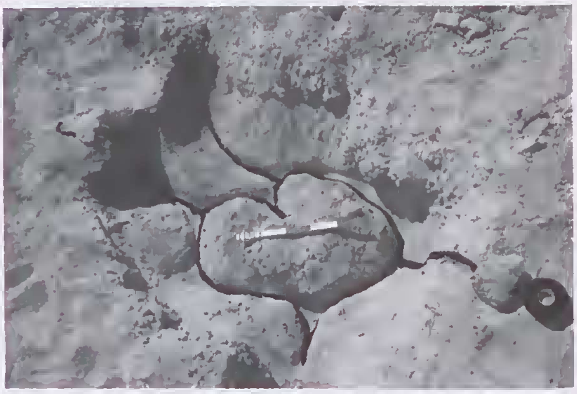

FIG. 1. Plan view of burrow complex with flagging tape highlighting tunnels. Scale divisions in 1 cm and 10 cm intervals (photo: HJ).

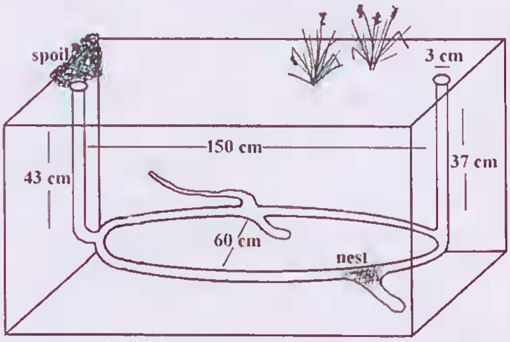

FIG. 2. Diagrammatic representation of burrow complex.

FIG. 3. Excavation (photo: JS).

18 cm, but then continued as a very narrow (2 cm) passageway. From this spur a live sub-adult male hopping-mouse was caught while trying to dig its way out.

Later, after releasing this subadult and driving away in our vehicle, another subadult was spotlit running from the opposite direction toward and eventually into the excavation pit from which it then quickly emerged and ran off. Within the 15 minutes it took us to drive approx. 2 km through claypan and gibber away from the excavation, we recorded by spotlighting an additional adult and a juvenile *N. cervinus* together, then a subadult, and finally two more juveniles*.

Some physical features of this burrow complex would appear to reduce the risk of snake predation. Firstly, it was positioned in stark 'lunar' habitat mostly devoid of vegetation or surface cracks, and so perhaps less likely to be visited by diurnal snakes due to the degree of exposure. Secondly, the horizontal elliptical nature of the tunnelling with the provision of pop holes at either 'end' of the loop could ensure escape from almost anywhere within the system. Thirdly, the nesting 'chamber' was not positioned at the end of a blind tunnel but in an expanded section of the main burrow. Even if nestlings were too young to escape, the reproducing adult(s) could. Blind galleries may be more important in providing points from which rapid-response exits can be dug when established exits are suddenly blocked. In this regard, the very narrow, upward rising tangential spur from which a subadult was collected toward the final sages of the excavation, probably represented the ongoing frantic execution of such a tunnel. Some features of the construction are more puzzling. For example, how, in the digging process 40 cm underground, do the mice connect the ends of the horizontal loop? How is burrow spoil (Fig. 4) moved up the vertical entrance/escape shaft? And why construct an all-horizontal system when stepping-up of burrow elements could provide early warning of incoming water or, escape from flooding?

Parts of Diamantina National Park were inundated by floodwaters between January and April 2009. This site was only 1.5 km from the main Diamantina River channel and at the same elevation (Fig. 6). Clearly, the superficial, contorting crust on the claypan on which the burrow excavation occurred indicated its relatively recent receipt of substantial rain and/or inundating floodwaters (Fig. 5). The ease of excavation (*ipso facto* burrow construction) through the homogeneous silt substrate may have resulted from relatively recent inundation, and the generational accumulation of burrow spoil may contribute to the establishment of the small raised hummocks that dot the claypans. In time these hummocks may deflect surface water from entrance tunnels, but their capacity to trap wind-blown seeds among grass tufts and scattered rubble, may be more significant.

While not labyrinthine in construction this one burrow complex builds on earlier reports that *N. cervinus* constructs 'very simple' burrows free of side galleries and devoid of radiating warrens (Finlayson 1939). It confirms that individuals live in small family groups (Finlayson 1939; Watts & Aslin 1981). We acknowledge however, that the burrow system we describe here may have been still

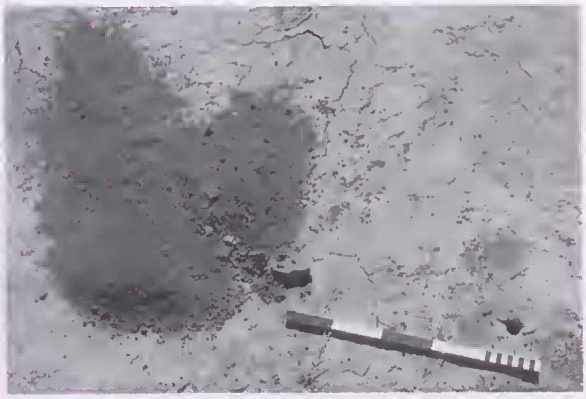

FIG. 4. Spoil plume from an adjacent *N. cervinus* burrow (photo JS).

FIG. 5. Northern view from excavation site across claypan (photo: HJ).

FIG. 6. Eastern view from excavation site toward Diamantina River channel (photo: HJ).

TABLE 1. Mammals trapped (T), hand-caught (H), or spotlit (S) in the vicinity of the excavation (all coordinates are GDA94) between 28 April and 4 May 2009 (975 trap-nights; 27 hrs spotlighting).

Dasyuroides byrnei	23°49'08.2"S, 141°11'18.9"E (T, adult M) 2/5/09
	23°45'48.2"S, 141°08'26.5"E (T, subadult F) 3/5/09
Planigale tenuirostris	23°34'35.9"S, 141°06'17.0"E (T) 1/5/09
Sminthopsis crassicaudata	23°33'37.0"S, 141°07'45.7"E (H) 30/4/09
	23°43'02.2"S, 141°10'56.5"E (T, juv) 4/5/09
Sminthopsis macroura	23°36'41.6"S, 141°03'15.2"E (T) 30/4/09
Notomys cervinus	23° 39' 44.2"S 141° 10' 38.6"E (H) (28/4/09)
	23° 41' 39.3"S 141° 04' 58.6"E (S) (29/4/09)
	23° 46' 35.4"S 141° 09' 08.5"E (H) (2/5/09)
	23° 45' 34.4"S 141° 08' 25.2"E (H) (2/5/09)
	23° 46' 08.9"S 141° 01' 13.6"E (H, 2 adult, 4 juv, 1 subadult) (S, 1 subadult) 4/5/09
	*23°45'50.0"S, 141°01'20.0"E (S, 1 adult, 1 juv) 4/5/09
	*23°45'31.6"S, 141°01'29.6"E (H, subadult) 4/5/09
	*23°45'10.0"S, 141°01'50.0"E (S, 2 juv) 4/5/09
Leggadina forresti	23°33'37.0"S, 141°07'45.7"E (H, juv) 30/4/09
	23°44'22.2"S, 141°10'30.6"E (H) 2/5/09

under construction, or may have been modified by reptiles or other mammals. Desert burrows are generally celebrated for ensuring cool humid conditions in hot climates but, inasmuch as this excavation occurred on a very cold night, it highlighted a burrow's capacity to also provide warm, humid conditions for adults and nestlings during periods of low ambient temperature.

Literature Cited

Finlayson, H.H. (1939). On mammals from the Lake Eyre Basin, Part IV. The Monodelphia. *Transactions of the Royal Society of South Australia* 63: 88-117 (as *Notomys aistoni*).

Watts, C.H.S. (1983). Fawn Hopping-mouse *Notomys cervinus*. Pp 432-433. *In* R. Strahan (ed.) *The Complete Book of Australian Mammals*. Angus and Robertson: Sydney.

Watts, C.H.S. & H.J. Aslin (1981). *The Rodents of Australia*. Angus and Robertson: Sydney.

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